Sayh al Uhaymir 300

Polymict impact melt breccia

152.6 g

Figure 1: Sayh al Uhaymir 300 in the desert in Oman (photo by R.. Bartoschewitz).

Introduction

Sayh al Uhaymir 300 (Fig. 1) was found in February 2004 in the Oman desert (Fig. 2). It is an olive-green flat and rounded rock with a resinous luster that may be due to desert weathering, since it has no fusion crust. The interior of the sample reveals a medium grey brecciated matrix with lighter clasts, metal flakes, and small vesicles (Russell et al., 2005; Bartoschewitz et al., 2005a). Some terrestrial alteration is present as white crystals in fractures - calcite and gypsum.

Petrography and mineralogy

Clasts within the breccia include troctolite, anorthositic olivine gabbro, olivine gabbro, anorthosite, wehrlite, dunite, clinopyroxenite, and gabbro (Hudgins et al., 2007). These rock types exhibit hypidiomorphic-granular, subophitic, poikilitic, and granular textures. Plagioclase feldpar is anorthitic with An_{95-96}, and olivine varies from Fa_{15} to Fa_{39}. Accessory minerals are kamacite, chromite, spinel, ulvospinel, ilmenite, armalcolite, and troilite. Feldspathic glass is also present, with 24 wt% Al_2O_3, 7.4 wt% FeO and 4.7 wt% MgO. Like many other feldspathic breccia lunar meteorites, the plagioclase (An) and pyroxene (Mg#) compositions bridge the gap between the FAN and HMS fields (Hsu et al., 2007; Hudgins et al., 2007).

Petrographic studies have generally come to two different conclusions regarding this lunar meteorite. Initially the presence of clasts with basaltic affinity, as well as it intermediate bulk compositional properties (FeO and Al_2O_3) led some to call it a basalt-bearing feldspathic breccia (Hsu et al., 2006, 2007; Bartoschewitz et al., 2005a). However, additional studies of textures and bulk composition have led some to call it a polymict impact melt breccia, based on the abundance of impact melts, impact melt breccias, and the consistently high siderophile element concentrations that is perhaps linked to a high meteoritic metal content (Hudgins et al., 2007). The latter evidence is strong enough to persuade this writer that it should be called a polymict impact melt breccia.

The shock history proposed for this meteorite is in three major stages. The first stage included formation of the shock features in the lithic clasts in a shock pressure range of 5 to 28 GPa. The second stage consisted of > 60 GPA and formed the fine grained igneous matrix of the sample. And a third phase included formation of melt veins and pockets, as well as localized maskelynitization perhaps between 28 and 45 GPa (Hudgins et al., 2007).

Chemistry

Bulk analyses have revealed a composition that is intermediate between mafic breccias and feldspathic end members, with 20 to 24 wt% Al_2O_3, 18-22 ppm Sc, 0.26 to 0.27 wt% TiO_2 and 0.46 ppm Th (Bartoschewitz et al., 2005b; Hudgins et al., 2007). Rare earth elements have been measured in mineral phases from some of the clasts and show an overall similarity to other lunar highlands breccias (Hsu et al., 2006, 2007). However, the lower Th and dearth of KREEP and mare basalt clasts has suggested a far side highlands terrane origin (Hsu et al., 2007; Hudgins et al., 2007). Siderophile elements (Co, Ni, Au and Ir) are in general very high for this sample (Bartoschewitz et al., 2005b). Noble gases are low in this meteorite, and may have been driven off during metamorphism to granulite grade (Bartoschewitz et al., 2005c), although there is a small amount of some noble gas isotopes due to cosmogenic production in the lunar regolith.

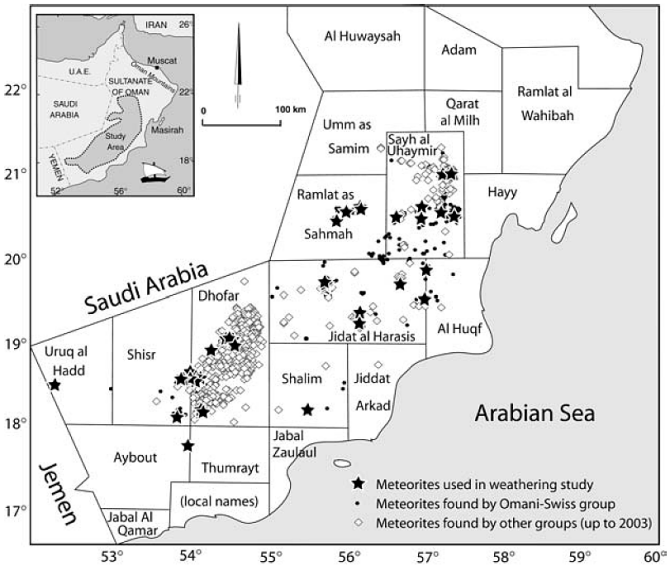

Figure 2: Map of Oman, sowing the Sayh al Uhaymir region just NE of center (from Al-Kathiri et al., 2005).

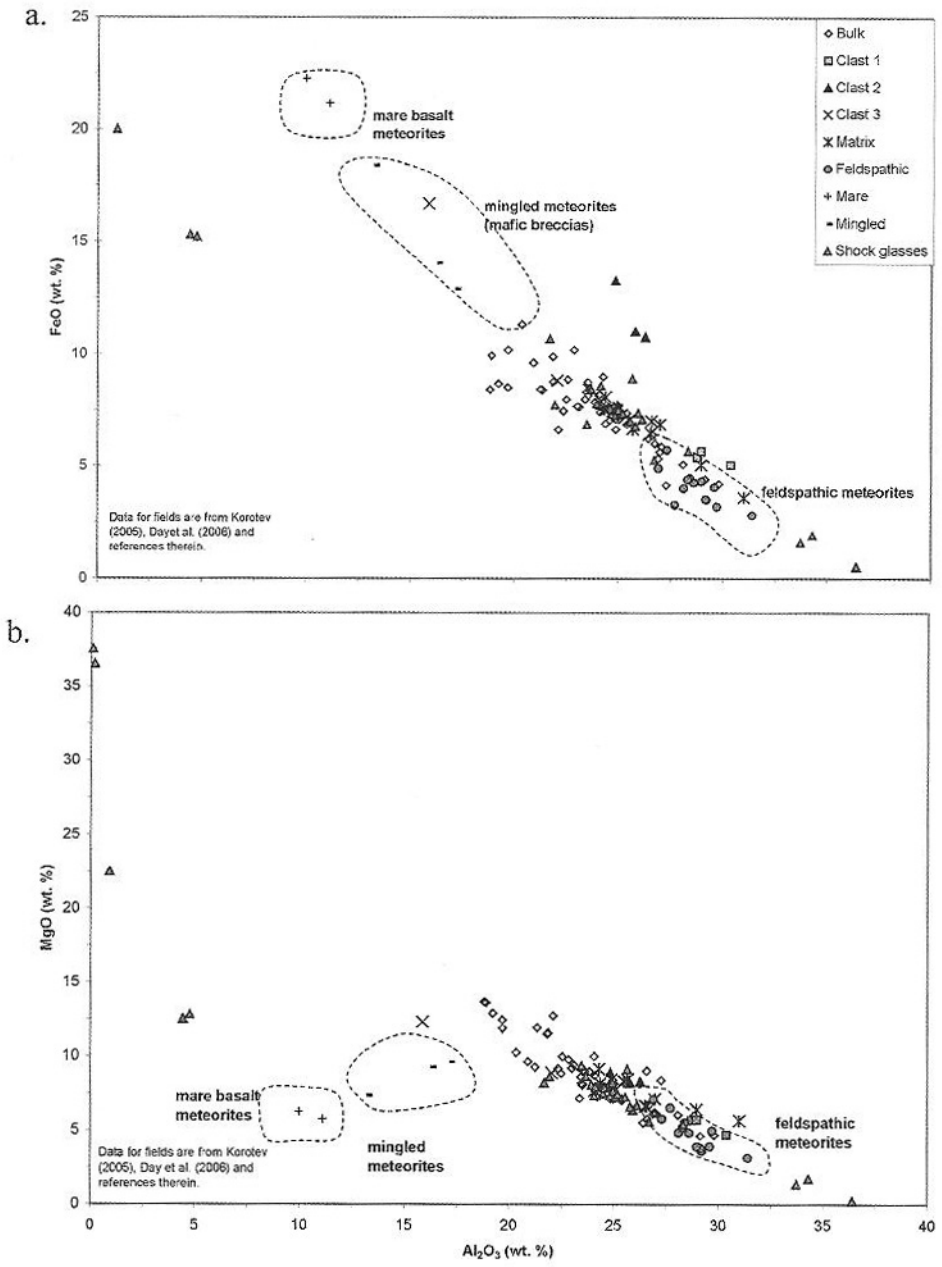

Figure 3: Bulk compositions of clasts and matrix from SaU 300 illustrating the overall feldspathic composition of this crystalline impact melt breccia (from Hudgins et al., 2007).